CMPG-767/CMPT-477 Image processing and Analysis

Project 6

Graduate Students:
(undergraduate students may work on this part and get 30 extra credit points, otherwise thir assignment is on the next page)

1. (**35 points**) *Adapt the following functions, which you designed earlier*, for color image processing using separate processing of RGB channels and processing of an extracted Y (luma-luminosity) channel from the YUV space with the further recreation of an RGB image (you may design your own functions for RGB-YUV and YUV-RGB transformations and get **10 extra credit points** or use Matlab functions rgb2ycbcr and ycbcr2rgb, to extract a Y channel and re-create and RGB image, respectively):

   a) a function utilizing a rank-order EV filter.

   b) a function utilizing a median filter with the differential rank-impulse detector (DRID).

   c) (**10 extra credit points in conjunction with 4**) a function utilizing a Sobel edge detector.

   d) (**10 extra credit points in conjunction with 4**) a function utilizing unsharp masking

2. (**30 points**) In the Pepper_Gaussian.tif image, which is shared with you, all its three color channels are corrupted by an additive Gaussian noise with a different standard deviation. Filter this image using a rank-order EV filter applied to each of RGB channels separately and only to the Y (luma-luminosity) channel. Compare the results of filtering to the original image Pepper.tif in terms of PSNR/RSME measured separately for each of the color channels and the Y channel. Turn in your resulting images.

3. (**30 points**) In the Pepper_Impulse.tif image, which is shared with you, all its three color channels are corrupted by an impulse noise with slightly different corruption rates of 0.007 – 0.012. Filter this image using a median filter with DRID applied to each of RGB channels separately and only to the Y (luma-luminosity) channel. Compare the results of filtering to the original image Pepper.tif in terms of PSNR/RSME measured separately for each of the color channels and the Y channel. Turn in your resulting images.

4. (**20 extra credit points in conjunction with 1c and 1d** or **10 extra credit points in conjunction with either of 1c or 1d)** Apply Sobel edge detector and unsharp masking to any original high quality color image of your choice. Process RGB color channels separately (when you apply unsharp masking, take into consideration that the weight k might be different for each color channel) and only the Y channel. Turn in your resulting images.

5. **(5 points**) Write a brief technical report with your results and conclusions about better approach to filtering based on the PSNR/RMSE valuesTurn in your source code, report, and resulting images.

Undergraduate Students

1. (**35 points**) Adapt the following functions, which you designed earlier, for color image processing using separate processing of RGB channels and processing of an extracted Y (luma-luminosity) channel from the YUV space with the further recreation of an RGB image (you may design your own functions for RGB-YUV and YUV-RGB transformations and get 10 extra credit points or use Matlab functions rgb2ycbcr and ycbcr2rgb, to extract a Y channel and re-create and RGB image, respectively):

   a) a function utilizing a smart linear filter.

   b) (**15 extra credit points if you use this filter in 2**) a function utilizing a rank-order EV filter.

   c) A function utilizing median filter

2. (**30 points**) In the Pepper_Gaussian.tif image, which is shared with you, all its three color channels are corrupted by an additive Gaussian noise with a different standard deviation. Filter this image using a smart filter (and rank-order EV filter for **extra credit**) applied to each of RGB channels separately and only to the Y (luma-luminosity) channel. Compare the results of filtering to the original image Pepper.tif in terms of PSNR/RSME measured separately for each of the color channels and the Y channel. Turn in your resulting images.

3. (**30 points**) In the Pepper_Impulse.tif image, which is shared with you, all its three color channels are corrupted by an impulse noise with slightly different corruption rates of 0.007 – 0.012. Filter this image using a median filter applied to each of RGB channels separately and only to the Y (luma-luminosity) channel. Compare the results of filtering to the original image Pepper.tif in terms of PSNR/RSME measured separately for each of the color channels and the Y channel. Turn in your resulting images.

4. **(5 points**) Write a brief technical report with your results and conclusions about better approach to filtering based on the PSNR/RMSE valuesTurn in your source code, report, and resulting images.